

MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION

1970 SUMMARY OF CLARK CANYON - BEAVERHEAD RIVER PROJECT

Abstract:

Fish populations were sampled in one section each of Red Rock River and Horse Prairie Creek and in four sections of Beaverhead River by electrofishing. Catch data are presented from all collections and population estimates are given for all sections where samples were of sufficient size to allow valid calculations. Fish in Clark Canyon Reservoir were sampled by gill and trap netting and by shore-line seining. Creel census data were collected from the reservoir. Angler catch and population data are presented and discussed as are physical and chemical water quality data collected from Clark Canyon Reservoir and Beaverhead River.

Management points of interest from work to date are:

1. Carp have been taken in the reservoir, but so far not in reservoir tributaries. If this continues to hold true in future work, it will mean barriers to upstream movement of rough fish are not necessary on reservoirs of Clark Canyon's type.
2. Reservoir summer fishing is still holding up as "good" at about 0.40 trout per hour. Most of this success is dependent upon stocked rainbow trout.

Reservoir winter fishing is excellent at over 1.5 fish per hour. Most of this is due to a popular but nongame fish (burbot).

3. Population data indicates that the abundance of yearling trout is abnormally low in certain sections of the Beaverhead River. If this condition persists, recruitment will be affected and the numbers of larger trout will probably decline in future years.

Findings:

The position of Project Leader on the Clark Canyon - Beaverhead River study was vacant from February, 1969, through May, 1970. During that time, the project was maintained on a part-time basis by other fisheries personnel. On April 1, 1970, the vacancy was filled and one person has devoted full time to the project since that time.

Considerable time was spent initially by the new Project Leader reviewing literature pertaining to the parameters of the project, reading and nomographing fish scales which had been collected since the project's inception, obtaining necessary field equipment and with general familiarization of the project's history and area.

The study area in 1970 included Horse Prairie Creek and Red Rock River (both reservoir tributaries), Clark Canyon Reservoir and Beaverhead River.

Data collection on streams was hampered considerably because of high flows in the Beaverhead drainage during 1970. A summary of the data obtained from the study area in 1970 and 1969 is presented.

Red Rock River

The 1969 trout population estimates were calculated for a 5,500-foot section of stream, located approximately two miles upstream from the mouth of Red Rock River. The section had an average width of 54.6 feet. Electrofishing was conducted during August when single marking and recapture runs were made.

Brown trout predominated, comprising 91% of the yearling and older trout population (Table 1). Yearling trout comprised 47.6% of the total brown trout population. Mountain whitefish and longnose suckers were abundant but were not quantitatively sampled ¹/_.

An attempt was made during July, 1970, to estimate the trout populations again in this 5,500-foot section. Due to high stream flows, an adequate sample was not obtained in the marking run; therefore, no trout population estimates could be made for this section in 1970. A total of 95 trout were captured during the single marking run. Brown trout predominated, comprising 85.1% of the total trout captured. Rainbow and brook trout comprised 13.8 and 1.1% of the total, respectively. Forty-three trout were tagged to evaluate harvest and movement.

Of the 208 anchor tags (Floy Tag and Manufacturing Co., No. FD-67) placed in trout in 1969, 3.8% have been returned, to date, by fishermen. The reported locations where the tagged trout were caught indicate that considerable movement occurs in this stream. Approximately half of the returns were from trout caught out of the sampling section; two had moved into the reservoir; one had moved through the reservoir and approximately seven miles downstream in Beaverhead River; and one had moved approximately 10 miles upstream in Red Rock River. Only one of the 43 anchor tags placed in trout in 1970 has been returned to date.

Horse Prairie Creek

Trout population estimates were made during July, 1970, on a 7,590-foot section located approximately two miles upstream from the mouth of Horse Prairie Creek. Brown trout were the most abundant species of trout with respect to both pounds and numbers (Table 2). Brown trout predominated and comprised an estimated 64.8% by number and 74.3% by weight of the yearling and older trout population. Rainbow and brook trout comprised 19.3 and 15.9%, respectively, by number and 16.0 and 9.7%, respectively, by weight of the yearling and older trout population.

Age group II predominated by number and age group III predominated by weight in the brown trout population (Table 2). Some age group II and older brown and rainbow trout had growth rates, general appearances and condition factors which were grossly different than those of other fish of the same species in the stream. It is possible that these trout immigrated into the section from the reservoir and have remained there as residents. Additional tagging in the stream and in the reservoir is needed to determine if this movement does occur.

¹/ _{Common names of fishes used in this report correspond to those presented in American Fisheries Society, Special Publication No. 2, 1960.}

TABLE 1. Estimated trout populations for a 5,500-foot section of Red Rock River, August, 1969, expressed in numbers and pounds per acre and per 1,000 feet (confidence interval at 95% level)

Species	Age group	Per acre		Per 1,000 feet	
		Number	Pounds	Number	Pounds
Brown trout	I	63	15.8	79	19.9
	II	37	23.4	46	29.4
	III	22	37.8	28	47.4
	IV	8	18.7	11	23.4
	V+	2	3.9	2	4.9
Total brown trout		132	99.6	166	
Confidence interval		89-175		112-220	
Rainbow trout	I	5	1.2	7	1.5
	II	4	2.3	5	2.9
	III	2	2.9	3	3.6
	IV	1	1.9	1	2.3
Total rainbow trout		12	8.3	16	
Confidence interval		4-20		6-26	
Total all trout, point estimate		144		182	
Confidence interval		93-195		118-246	

Other species of fish collected were mountain whitefish, white suckers, longnose suckers, longnose dace and mottled sculpin. No attempt was made to estimate their populations.

Clark Canyon Reservoir

During the middle of May, 1970, 11 trap nets (one inch mesh) were set at various shore locations in Clark Canyon Reservoir (Figure 1). A total of 2,091 fish were captured in the eight successful trap net sets (Table 3). Three of the sets (B2, B3 and D2, Figure 1) collapsed, due to excessive wave action, before any fish could be captured.

White suckers predominated in the trap nets and comprised 92.6% of the relative species abundance (Table 3). From 1969 to 1970, white suckers increased in the catch from 61.8 to 242.1 per net day. White and longnose suckers were in a spawning stage during June, 1969, and May, 1970, trap netting operations. Therefore, the increase per net day probably reflects a difference in gregarious tendencies related to spawning condition rather than an actual change in abundance from 1969 to 1970. Longnose suckers decreased from 17.8 to 5.9 per net day, while burbot decreased from 74.8 to 11.1 per net day. The increase in white suckers

TABLE 2. Estimated trout populations for a 7,590-foot section of Horse Prairie Creek, July, 1970, expressed in numbers and pounds per acre and per 1,000 feet (confidence interval at 95% level)

Species	Age group	Per acre		Per 1,000 feet	
		Number	Pounds	Number	Pounds
Brown trout	I <u>1</u> /	9	1.5	7	1.1
	II	23	12.4	17	9.6
	III	13	24.3	10	18.7
	IV	8	15.8	7	12.1
	V	4	6.7	3	5.2
Total brown trout		57	60.7	44	46.7
Confidence interval		42-72		32-56	
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Total rainbow trout	I-IV	17	13.1	13	10.1
Confidence interval		8-26		6-20	
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Total brook trout	I-III <u>1</u> /	14	7.9	10	6.1
Confidence interval		2-26		1-19	
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Total all trout, point estimate		88	81.7	67	62.9
Confidence interval		52-124		39-95	

1/ Fewer than seven recaptures, which causes a negative bias.

TABLE 3. Combined catch data from eight trap net sets in Clark Canyon Reservoir, May, 1970

Species	No.	% of total	No. per net day	Size-range in inches	Average total length in inches	Average weight in pounds
Rainbow trout	4	.2	.5	13.0-17.5	14.8	1.36
Brown trout	8	.4	1.0	19.2-23.1	20.6	2.53
Mountain whitefish	6	.3	.8	11.9-18.2	16.1	1.50
White sucker	1,937	92.6	242.1	7.3-18.8	14.8	1.62
Longnose sucker	47	2.2	5.9	13.2-19.4	15.9	1.67
Burbot	89	4.3	<u>11.1</u>	14.2-30.4	19.9	1.98
Total	2,091		261.4			

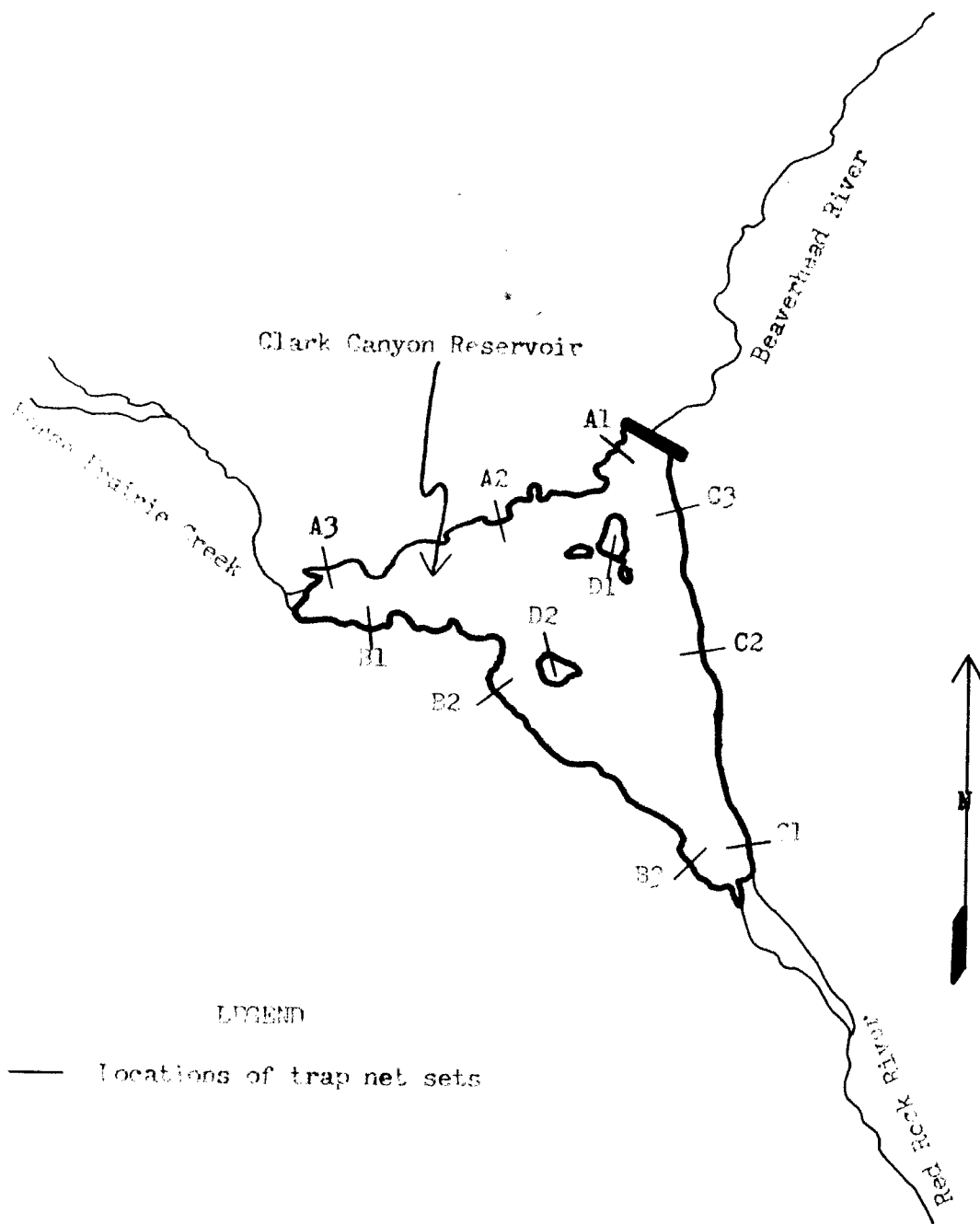


FIGURE 1. Clark Canyon Reservoir showing locations of trap net sets, May 1970.

and the decreases in longnose suckers and burbot were the only apparent significant changes which occurred from 1969 to 1970 with respect to relative species abundance. The total number of fish per net day was 156.4 and 261.4 in 1969 and 1970, respectively.

Longnose suckers were captured at only two locations, B1 and C1, while white suckers were taken at all eight locations (Table 4).

Fish scales from all species collected during the trap netting operations of May, 1970, have been mounted and read. Only white sucker scales have been nomographed. The growth rate of white suckers in the reservoir is above the average for Montana lakes. The average total length, in inches, at each annulus for white suckers collected in lakes throughout Montana during the period July 1, 1962, to June 30, 1963 (Peters, 1964), was 2.1, 5.8, 9.0, 11.6, 12.9, 14.9 and 15.4 for annuli I, II, III, IV, V, VI and VII, respectively. The weighted average in Clark Canyon Reservoir for annuli I, II, III, IV, V, VI and VII, respectively, are 1.5, 5.4, 10.6, 13.4, 14.7, 16.3 and 17.0 (Table 5).

Brown trout scales were collected during the 1969 season by setting trap nets and at the 1969 Clark Canyon Trout Derby. The growth rate of brown trout collected in these two ways was also above the average 1962-63 rate for brown trout in Montana lakes. The average total length, in inches, at each annulus in Montana lakes was 3.5, 8.8, 13.1, 15.7, 17.6 and 19.6 for annuli I, II, III, IV, V and VI, respectively (Peters, 1964). The weighted average total length in Clark Canyon Reservoir for the respective annuli are 4.6, 12.5, 17.7, 20.2, 22.2 and 25.2 (Table 6).

Day seining, using a 200 x 12 foot nylon seine, on July 15, 1970, produced 38 rainbow trout in seven seine hauls for a rate of 5.4 trout per seine haul. Thirty-five were classified as hatchery rainbow trout, and 32 of these, averaging 8.8 inches in total length, were assumed to be from the 1970 subcatchable plants. Burbot was the only other species obtained using this method.

Night seining, on September 9, 1970, produced 36 rainbow trout, 37 white suckers and 7 carp. The number of rainbow trout caught per seine haul was 9.0. Thirty-three rainbow were classified as having come from hatchery plants.

A total of 12,500 subcatchable hatchery rainbow trout were adipose clipped in May at the Montana Fish and Game Department trout hatchery near Bluewater Creek. The number of trout marked represents 10% of the total 1970 hatchery plant in Clark Canyon Reservoir. The marked trout will be used as an aid in estimating the total number of hatchery rainbow trout which may migrate from the reservoir into Horse Prairie Creek, Red Rock River and Beaverhead River. The marking of the hatchery trout will also aid in their identification during creel surveys.

Limited creel surveys were conducted to obtain harvest information. During February on Clark Canyon Reservoir, a total of 57 fishermen were contacted for creel information. The catch-rate for game fish (rainbow and brown trout) and nongame fish (burbot) was 0.19 and 1.40 fish per fisherman-hour, respectively. The total catch-rate was 1.59 fish per fisherman-hour. During July and September, 68 fishermen were contacted for creel information. During 256 fisherman-hours, 103 game fish were caught for a catch-rate of 0.40 game fish per fisherman-hour. The catch-rate was better in September than in July.

TABLE 4. Number of fish taken in eight successful trap net sets in Clark Canyon Reservoir, May, 1970

Set	Species					
	White sucker	Longnose sucker	Burbot	Mountain whitefish	Brown trout	Rainbow trout
A1	226		22			
A2	30				1	
A3	166		20	1		
B1	854	41	8		2	
C1	147	6	26	4	5	4
C2	151		5	1		
C3	320		8			
D1	43					
Total	1,937	47	89	6	8	4

TABLE 5. Average calculated total lengths (inches) of white suckers collected from Clark Canyon Reservoir, May, 1970

Age group	Number	Year of life							
		1	2	3	4	5	6	7	8
I	0	-							
II	2	1.8	7.7						
III	24	1.8	6.2	11.5					
IV	8	1.3	5.9	10.0	12.8				
V	39	1.4	5.4	10.8	13.1	14.0			
VI	30	1.4	4.9	10.4	14.2	15.6	16.2		
VII	5	1.5	4.1	9.2	12.9	15.2	16.5	17.1	
VIII	1	1.8	4.4	8.1	11.8	14.1	15.2	16.4	17.3
Average		1.6	5.5	10.0	13.0	14.7	16.0	16.7	17.3
Weighted average		1.5	5.4	10.6	13.4	14.7	16.3	17.0	17.3

TABLE 6. Average calculated total lengths (inches) of brown trout collected from Clark Canyon Reservoir, May and June, 1969.

Age group	Number	Year of life						
		1	2	3	4	5	6	7
I	0	-						
II	1	5.3	11.5					
III	5	4.8	12.2	18.5				
IV	23	4.5	13.2	17.7	19.8			
V	17	4.5	11.6	17.2	20.6	21.9		
VI	2	4.9	13.2	19.4	21.8	23.2	24.1	
VII	1	6.0	14.2	19.3	21.4	25.7	27.6	28.7
Average		5.0	12.6	18.4	20.9	23.6	25.8	28.7
Weighted average		4.6	12.5	17.7	20.2	22.2	25.2	28.7

In 1969, a total of 34 trout were tagged with numbered anchor tags in Clark Canyon; 27 were tagged in 1970. To date, 26% of the 1969 tags and 15% of the 1970 tags have been returned. These rates of return are much higher than reported on Montana streams and indicate that a large percent of the catchable population of trout is being harvested.

A series of chemical and physical tests of the reservoir was begun during June, 1970. This series will be conducted every three months to determine seasonal, as well as yearly, changes in chemical and physical parameters. Three locations were chosen from which to take samples. Location 1 was near the mouth of Horse Prairie Creek, location 2 was near the mouth of Red Rock River and location 3 was approximately $\frac{1}{4}$ mile above the dam, midway between shorelines. The highest turbidity reading, 32 ppm, was at location 1 during June (Table 7).

During July and August, 1970, D.O. (dissolved oxygen) concentrations were measured at 10-foot intervals and temperature readings were recorded at one-foot intervals at location 3. On July 16, a thermocline had developed at depths between 24 and 34 feet. Temperatures ranged from 56° F. at the bottom (80 feet) to 69° F. at the surface. The hypolimnion had D.O. concentrations ranging from 0-1 ppm at the bottom to 4 ppm at the 40-foot depth level. The D.O. concentration at the surface was 7-8 ppm. On July 30, the thermocline was located between 39 and 46 feet. Temperatures ranged from 58° F. at the bottom of the reservoir to 68° F. at the surface. D.O. concentrations were 1, 2 and 6 ppm at the bottom, the 50-foot depth and the surface, respectively. On August 24, the thermocline was no longer evident. Temperatures ranged from 61° F. at the bottom to 66° F. at the surface. D.O. concentrations ranged from 0 to 8 ppm from bottom to surface. Tests for the presence of hydrogen sulfide (H₂S) were made from June through August, but H₂S was not present in measurable quantities.

TABLE 7. Chemical and physical measurements from three locations on Clark Canyon Reservoir, June and September, 1970.

Date	Area	No. of ft. from bottom	Water temp. ° F.	Turbidity JTU l/	pH	D.O. ppm	Nitrate/nitrogen		Nitrate ppm	H ₂ S ppm	Total alkalinity ppm	Calcium hardness ppm	Total hardness ppm	Orthophosphate ppm
							ppm	ppm						
June	1	3	54	10	7.5	-	-	6	26	-	150	100	160	3.8
	2	3	48	32	7.6	-	-	12	53	-	240	150	235	1.5
	3	3	54	3	8.1	4	3	13	0	-	-	-	-	0.8
		40	60	0	-	7	7	31	-	-	-	-	-	0.3
		80	61	0	-	8	-	-	-	-	-	-	-	-
			(Surface)											
Sept.	1	3	-	0	8.1	-	-	-	-	-	210	-	235	-
	2	3	-	0	8.4	-	-	-	-	-	210	165	235	-
	3	3	-	0	8.0	-	3	13	0	210	170	240	240	0.7
		40	-	0	8.2	-	4	18	-	210	150	230	230	0.5
		80	-	0	8.3	-	4	18	-	205	150	235	235	0.7
			(Surface)											

1/ Jackson Turbidity Units.

Beaverhead River

The Hildreth section was electrofished in March and October of 1969. This 6,425-foot section is located approximately two miles downstream from Clark Canyon Dam. The October population estimate for brown trout was 172 per 1,000 feet (Table 8). The total pounds per 1,000 feet was estimated to be 303.1 and 77.3 for brown and rainbow trout, respectively (Table 8). Age group I predominated with respect to numbers and age group II predominated with respect to pounds for both trout species (Table 8).

The Pipeorgan section was electrofished in March and October of 1969. This 8,250-foot section is located approximately seven miles downstream from the dam. The October population estimates for brown trout were 189 per 1,000 feet and for rainbow trout, 6 per 1,000 feet (Table 9). Total pounds per 1,000 feet was estimated to be 238.7 and 10.0 for brown and rainbow trout, respectively (Table 9). Age group II brown trout predominated in both numbers and pounds per 1,000 feet (Table 9).

The Hildreth and Pipeorgan sections were electrofished again in March and October of 1970. Two marking runs were used during both periods of the year. One recapture run was necessary in March when electrofishing was done with discharges of 100 cfs, but two were necessary in October when discharges were 200 cfs.

In the Hildreth section, a total of 315 trout were tagged with numbered and 40 with unnumbered anchor tags during the March electrofishing operation. Brown trout predominated and comprised 73% by number of the estimated March trout populations, while rainbow trout comprised 17%. Only one brook trout was captured in the three electrofishing runs. The total estimated brown trout per 1,000 feet in this section was 76, while rainbow trout totaled 28 per 1,000 feet (Table 10). Total pounds per 1,000 feet was estimated to be 143.2 and 65.1 for brown and rainbow trout, respectively (Table 10). Age group III brown and rainbow trout predominated with respect to numbers (Table 10). Age group III brown trout and age groups III and IV rainbow trout predominated with respect to pounds (Table 10).

In the Pipeorgan section, 574 trout were tagged with numbered anchor tags during March electrofishing. The total numbers per 1,000 feet for brown and rainbow trout, in March, were estimated to be 145 and 7, respectively (Table 11). The total pounds of brown trout per 1,000 feet was estimated to be 148.1 (Table 11). Age group III predominated, with respect to both numbers and pounds, in the brown trout population estimates (Table 11).

The total winter mortality, more correctly termed "total winter population decrease", for the period October, 1968, to March, 1969, in the Hildreth section was 37.4% (Table 12). For the period October, 1969, to March, 1970, the total winter mortality was 56.2% (Table 12). Both age groups I-II and II-III mortality rates increased considerably from the 1968-69 winter to the 1969-70 winter (Table 12).

The total winter mortality in the Pipeorgan section for the period October, 1969, to March, 1970, was 32.1% (Table 12). The data from both 1969 and 1970 indicate that yearling fish are less abundant than would be expected in this population. This could be a result of adverse spawning conditions and/or poor survival of eggs or small fish. If this continues, the abundance of larger trout will probably decline.

TABLE 8. Estimated number and pounds of brown and rainbow trout per 1,000 feet per age group in the 6,425-foot Hildreth section of Beaverhead River, October, 1969 (confidence interval at 95% level)

	Age group	Brown trout		Rainbow trout	
		Number	Pounds	Number	Pounds
	I	80	75.3	13	12.4
	II	77	170.1	9	30.0
	III	8	31.3	4	15.7
	IV	7	26.4	3	14.4
	V	-	-	1	4.8
Total		172	303.1	30	77.3
Confidence interval		120-224		19-41	

TABLE 9. Estimated number and pounds of brown and rainbow trout per 1,000 feet per age group in the 8,250-foot Pipeorgan section of Beaverhead River, October, 1969 (confidence interval at 95% level)

	Age group	Brown trout		Rainbow trout	
		Number	Pounds	Number	Pounds
	I	77	54.7	3	2.2
	II	96	149.8	2	5.4
	III	15	32.5	0.7	2.4
	IV	0.5	1.7	-	-
Total		189	238.7	6	10.0
Confidence interval		144-234		<u>1/</u>	

1/ Sample too small to estimate 95% confidence interval without negative bias.

TABLE 10. Estimated number and pounds of brown and rainbow trout per 1,000 feet per age group in the 6,425-foot Hildreth section of Beaverhead River, March, 1970 (confidence interval at 95% level)

	Age group	Brown trout		Rainbow trout	
		Number	Pounds	Number	Pounds
	II	20	20.5	5	5.0
	III	41	76.8	13	24.1
	IV	11	34.6	7	24.2
	V	3	10.1	3	11.8
	VI	0.3	1.2	-	-
Total		76	143.2	28	65.1
Confidence interval		59-93		21-35	

TABLE 11. Estimated number and pounds of brown and rainbow trout per 1,000 feet per age group in the 8,250-foot Pipeorgan section of Beaverhead River, March, 1970 (confidence interval at 95% level)

	Age group	Brown trout		Rainbow trout	
		Number	Pounds	Number	Pounds
	I	17	1.0	<u>1/</u>	<u>1/</u>
	II	50	34.8		
	III	71	97.7		
	IV	6	12.2		
	V	1	2.4		
Total		145	148.1	7	
Confidence interval		115-175		<u>2/</u>	

1/ Too few in any age group for valid estimate. Age groups I, II, III and IV were present in the sample.

2/ Sample too small to estimate 95% confidence interval without negative bias.

TABLE 12. Rates of population decrease (mortality rates) of brown trout for the periods October, 1968, to March, 1969, and October, 1969, to March, 1970, in the Hildreth and Pipeorgan sections of Beaverhead River

Section	Period	Age group				Weighted mean
		I-II	II-III	III-IV	IV-V+	I-V+
Hildreth	10/68 <u>1</u> / - 3/69	.526	.173	.176	<u>2</u> /	.374
	10/69 - 3/70	.750	.467	<u>3</u> /	.528	.562
Pipeorgan	10/68 - 3/69	-	-	-	-	-
	10/69 - 3/70	.351	.260	.600	<u>4</u> /	.321

1/ From Elser (1969).

2/ The population increased; the survival rate was 1.250.

3/ The population increased; the survival rate was 1.370.

4/ The population increased; the survival rate was 2.000.

In the Hildreth section, total numbers as well as certain age groups may have been affected prior to 1968 by hydrogen sulfide emissions from the reservoir in 1965 (Needham and Wipperman, 1966). Dewatering may also be a factor influencing survival of young fish. Up to 90% dewatering was recorded in July of 1966 and the spring of 1967 (Wipperman, 1967). High summer flows may also adversely affect the survival of fry and fingerlings.

Point estimates of the October trout populations in the Hildreth section show that age groups I and II have proportionally increased in the brown trout population in 1968 and 1969 from the 1966 and 1967 totals (Table 13). Brown trout in age groups III and IV have declined during this four-year period. Total numbers and total pounds of brown and rainbow trout have increased during this period (Table 13).

To date, October, 1970, population estimates for both sections have not been computed. During the fall electrofishing operations on the two sections, a total of 1,117 trout were handled in the marking and recapture runs. Some movement and/or displacement of marked fish was observed. The movement will be evaluated with regard to influence on population estimates.

Unsuccessful attempts were made to estimate the trout populations of two additional sections on Beaverhead River, Wheat and Sportsman's Park. The 9,640-foot Wheat section is located immediately upstream from Dillon. Two marking and two recapture runs were made in August on this section, but inadequate recapture sample size prevented the estimation of trout populations. A total of 325 trout were tagged with numbered anchor tags in the Wheat section. Only one marking run was attempted on Sportsman's Park, when large discharges prevented obtaining a desired sample size; therefore, further electrofishing runs were not attempted.

TABLE 13. Point estimates of brown and rainbow trout per 1,000 feet in the Hildreth section of Beaverhead River in October, 1966, 1967, 1968, and 1969

Species	Age group	1966 <u>1/</u>	1967 <u>1/</u>	1968 <u>2/</u>	1969
Brown trout	I	15	9	76	80
	II	40	19	29	77
	III	37	31	17	8
	IV	23	39	4	7
	V	-	-	1	-
Total number		115	98	127	172
Total pounds		272	249	224	303
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Rainbow trout					
Total number		19	20	22	30
Total pounds		34	61	53	77
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Brown and rainbow trout					
Total number		134	118	149	202
Total pounds		306	310	277	380

1/ From Wipperman and Elser, 1968.

2/ From Elser, 1968.

Tag returns by fishermen from the trout tagged in March, 1970, total 23 (7.3%) from Hildreth and 25 (4.4%) from Pipeorgan. These relatively low return rates indicate that angler harvest accounts for only a small part of total mortality and thus has little effect on standing crop. Although Beaverhead River is open to year-round fishing, all returns except one from January were from trout caught between mid-March and mid-September. Most trout were caught in the general vicinity where they were tagged.

The average five-day maximum water temperatures were computed for two locations on Beaverhead River (Figure 2). Thermographs were located 15 (Barrett's) and 48 (Blaine) stream miles below Clark Canyon Dam. Temperatures were monitored at these two locations from mid-June through mid-September of 1969 and 1970.

The temperature patterns were similar between years (peaks in late July and August) except that 1970 water temperatures were generally lower and fluctuated less (Figure 2). This would be indicative of the higher stream flows in 1970. During both years, the temperatures at Barrett's were cooler and fluctuated less than at Blaine (Figure 2). This would indicate that reservoir effects upon the Beaverhead River water temperatures are still evident at least 15 stream miles below the dam.

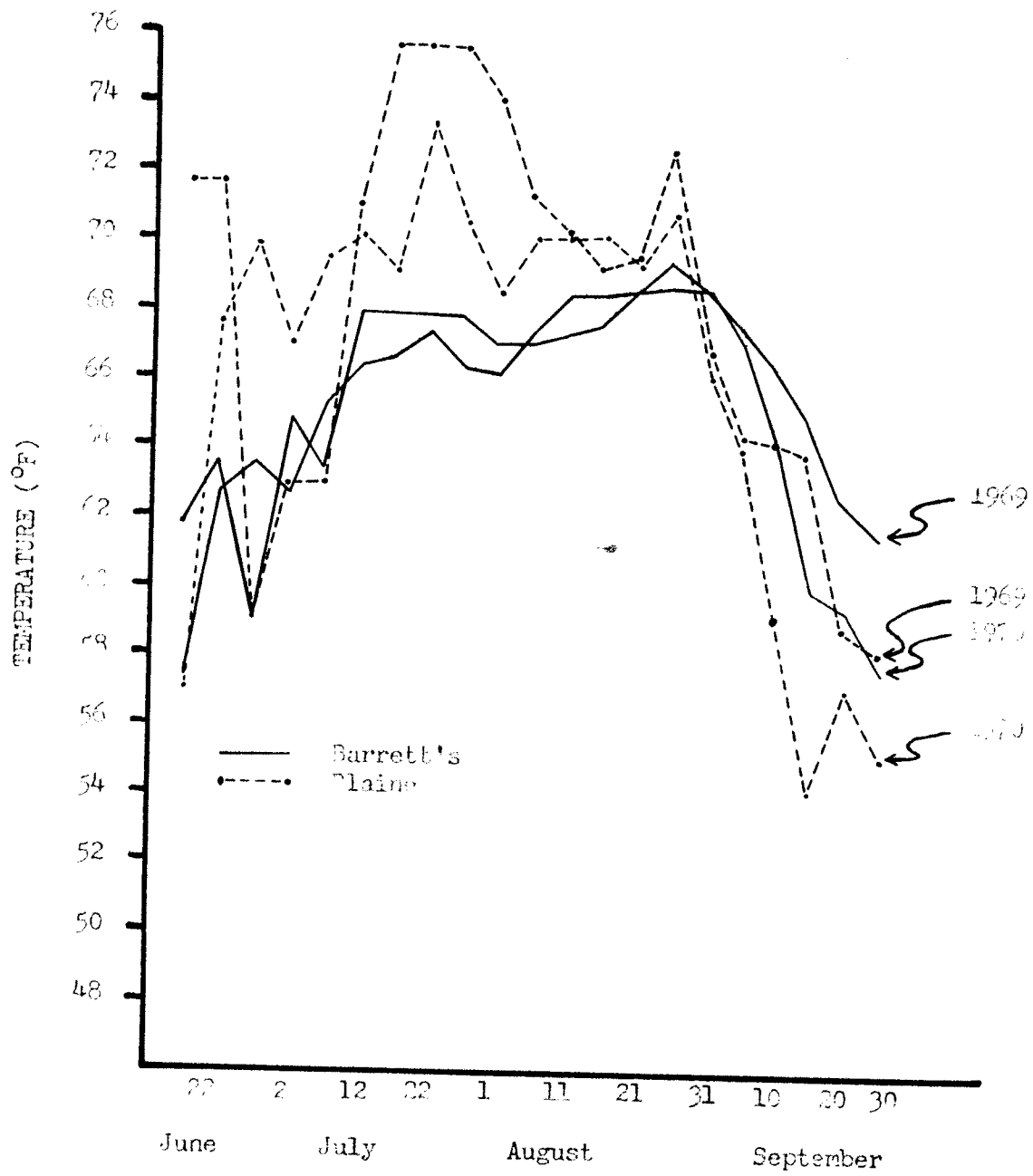


FIGURE 2. Average five-day maximum water temperatures for two stations on Beaverhead River, 1969 and 1970.

A series of chemical and physical tests was made in June on the Beaverhead River and will be repeated every three months. Sampling stations were at six locations on Beaverhead River - three above the town of Dillon and three below. These stations, described in Table 14, are located such that changes in the measured chemical and physical parameters can be monitored from Clark Canyon Dam to the mouth of Beaverhead River.

General increases in turbidity, ortho-phosphates and total alkalinity were recorded (Table 14) from the dam to the town of Twin Bridges, a distance of 70 stream miles. The only major changes from June to September were in turbidity and perhaps ortho-phosphates (Table 14).

Dissolved oxygen concentrations were determined during a 24-hour period at five locations on Beaverhead River on September 22 and 23, 1970. The concentrations in the Hildreth section (two miles below the dam) were consistently lower than in other sections (Figure 3). Decreased oxygen concentrations in the Hildreth section may be the result of higher temperatures below the dam at this time of year (Figure 2) and/or other reservoir effects.

Stream profile measurements were begun on the Wheat section. High flows prevented completion of this phase of the study in 1970. When all physical measurements are obtained and trout population estimates are made, an attempt will be made to relate stream profile, stream habitat at various flow levels and annual flow patterns to trout populations and their growth increment in this section. The effect of high flows on bank deterioration will also be studied.

Planned Operation for 1971:

Electrofishing operations on Red Rock River and Horse Prairie Creek will be continued to evaluate game and nongame species population abundance and changes. Extensive marking of trout and nongame species will be conducted in Clark Canyon Reservoir. Collection of fish will be by trapping and possibly electrofishing. An attempt will be made to evaluate the effects of migration from the reservoir, during trout and nongame species spawning periods, upon the resident trout populations in the two tributaries.

A series of 18 overnight gill net sets will be made in Clark Canyon Reservoir during June. The resultant data will be compared to the 1968 gill net series (Elser, 1969) for trend information.

Trout age and growth relationships, past and present, of all waters will be evaluated.

The chemistry series will be run four times a year on the reservoir and Beaverhead River.

A more extensive creel survey is planned for the reservoir and Beaverhead River. An estimate of total yield and total fishing intensity for the reservoir and river will be made.

The Hildreth and Pipeorgan sections will be electrofished semi-annually in order to evaluate relative species abundance, population changes and summer and

TABLE 14. Chemical and physical measurements from six locations on Beaverhead River, June and September, 1970

Date	Location	H ₂ S ppm	Turbidity JTU 1/	pH	D.O. ppm	Nitro- gen ppm	Nitrate ppm	Total alka- linity ppm	Calcium hard- ness ppm	Total hard- ness ppm	Ortho- phos- phate ppm
June	GS	0	0	8.1	9	9	40	-	-	-	0.6
	P	-	10	7.9	9	8	35	210	140	240	0.9
	T	-	10	8.0	9	6	27	200	140	230	1.0
	SP	-	25	8.1	8	6	27	220	150	240	1.7
	B	-	25	8.3	7	7	31	240	180	300	1.8
	TB	-	20	8.2	8	7	31	200	150	250	1.9
Sept.	GS	0	0	8.0	-	5	22	215	150	230	0.3
	P	-	1	8.3	-	6	26	210	150	240	0.6
	T	-	1	8.1	-	4	18	215	165	235	0.5
	SP	-	1	8.2	-	7	31	210	200	255	0.5
	B	-	2	8.4	-	8	35	235	200	285	0.5
	TB	-	3	8.1	-	2	9	230	220	280	0.7

1/ Jackson Turbidity Units.

GS = Gauge station immediately below Clark Canyon Dam.

P = Highway bridge at Pipeorgan.

T = Highway bridge near the Tash Ranch.

SP = Sportsman's Park.

B = Blaine gauge station near "Point-of-Rocks".

TB = Twin Bridges.

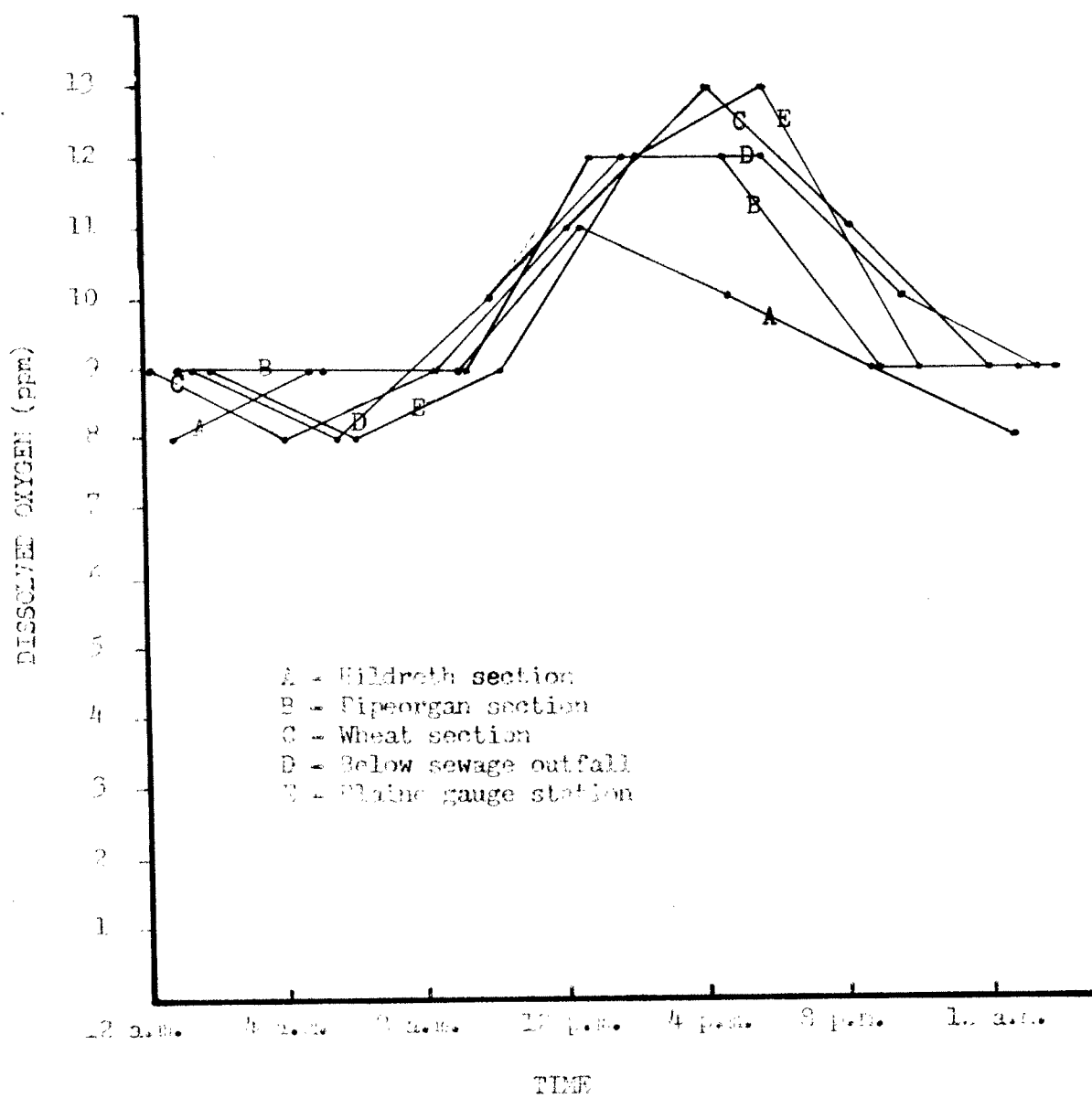


FIGURE 3. Dissolved oxygen concentrations during a 24-hour period at five locations on Beaverhead River, September 22 and 23, 1970.

winter mortality. The Wheat (or Tash) section, the Sportsman's Park section and a section downstream from Blaine will be electrofished. Annual summer population estimates of young-of-the-year trout will be made in all sections. Young-of-the-year populations will be compared to flow patterns, temperatures and other physical and chemical variables which may affect them.

An attempt will be made to determine the relationships between stream profile, stream habitat at various flow levels, annual flow patterns and the trout populations in an experimental section of Beaverhead River.

Transects will be set up to determine the rates of bank erosion at various flow levels and patterns in certain sections of the stream. Transects will be on the outside of river bends and on straight riffle areas.

The Beaverhead River temperatures at Barrett's and Blaine will be monitored during the summer months.

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